

Appl. No. 09/926,003
Response dated: August 22, 2003
Reply to OA of: March 25, 2003

REMARKS

Applicants have amended the claims by canceling withdrawn claim 3 from the application without prejudice or disclaimer and reserve all rights to filing a divisional application to the subject matter considered by the Examiner to represent a patentably distinct invention.

In addition, Applicants submit herewith a RCE along with the necessary petition for an extension of time and payment of the required fees. The amendment previously and which was not entered has been further amended by adding additional claims to specific ratios as fully supported by Applicants' specification, see for example Table 1. Applicants believe that the present amendment places the application in condition for allowance, but if this is not the case, Applicants request that the Examiner contact the undersigned attorney so that an interview can be arranged to determine what further amendments may be necessary to place the application in condition for allowance or in the best condition for proceeding with an appeal.

Claim Rejections - 35 USC § 103 (a)

The Examiner in charge rejected claims 1 and 2 of the present application under 35 U.S.C. 103(a) as being unpatentable over Shneerov et al. (US Pat. 4,843,212) and Cary. This rejection has been carefully considered but is most respectfully traversed.

Grounds for claim rejections presented by the examiner in charge are as follows: Shneerov et al. discloses a welding wire which is plated with copper. (However, the Examiner does not point out where in the reference is there any teaching of plating the copper onto the wire as required by the present invention.) Welding wire is made from welding rods which are cold drawn to a diameter of 0.8 mm. (This is taught at column 5, line 10 of the reference. See the paragraph bridging columns 4 and 5 which states that the source components (which include copper) are loaded in the required amount into a steel-melting plant, melted, held as long as necessary and is charged into the

Appl. No. 09/926,003

Response dated: August 22, 2003

Reply to OA of: March 25, 2003

steel-pouring ladle and mould. The metal is cast into ingots which are then rolled into wire rod(s). There is no teaching of coating the wire with copper as required by the presently claim invention. This is a claim limitation which cannot be ignored.) The ultimate tensile strength is 830 to 1320 MPa. Exact yield strengths are not taught. Cary discloses the mechanical properties which range from 450 to 830 MPa for tensile strengths and 390 to 740 MPa for yield strengths. The resulting ratios range from 45 to 88 %. It would have been obvious to one of ordinary skill in the art to use the mechanical properties of Cary in the Shneerov et al. wire because these are drawn to the same welding wire products.

The prior art discloses a product substantially similar to a claimed product, differing only in the manner by which it is produced. (This statement is specifically traversed.) It has been held that one of ordinary skill in the art at the time of the invention would have considered the claimed compositions to have been obvious because of the similarity in the properties, and overlapping ranges. The burden falls to the applicant to show that any process steps associated with the claimed product result in a materially different product from those of the prior art, because there is nothing in the record before the examiner to reasonably conclude that applicant's product differs in kind from those obtained by the references.

Additional Response to Claim Rejections - 35 USC § 103(a)

See the requirements for establishing a prima facie case of obviousness set forth in the previous amendment and herein incorporated by reference. The present invention relates to a welding solid wire, and more particularly to a welding solid wire with high feeding performance and arc stability on welding.

US Pat. 4,843,212 to Shneerov et al. (hereinafter, referred to as "cited reference 1") relates to ferrous metallurgy, and more particularly to compositions of welding wire. The paper written by Cary (hereinafter, referred to as "cited reference 2") generally discloses mechanical properties of welding wires.

Appl. No. 09/926,003
Response dated: August 22, 2003
Reply to OA of: March 25, 2003

Comparison between the present invention and cited reference 1 in terms of object, construction, and effect will now be made in detail, and subsequently the reason why the present invention is not obvious from cited reference 2 will be fully described.

1. Detailed comparison between the present invention and cited reference 1

(1) Object

It is the object of the present invention to provide a welding solid wire with high feeding performance and arc stability on welding.

It is the object of cited reference 1 to provide a composition of a welding wire widely useful in making large metal structures and elements from carbon and low-alloy steels.

As shown in Fig. 2 of the present application, the wire is subjected to large resistance at contact points where the wire and the inner wall of a cable are contacted with each other in a bent portion of the cable in the course of feeding the wire. The object of the present invention is to minimize the aforesaid resistance of the wire by closely examining the elastic limit ratio of the wire. When the wire passes through the bent portion X or Y of the cable, the wire is subjected to large resistance, which is different depending upon whether the wire is soft or hard. The resistance of the wire is generated even when the wire is slightly bent. Consequently, the object of the present invention is to provide a wire with high feeding performance while the resistance of the wire is decreased between the bent portion and the straight welding tip portion.

On the other hand, cited reference 1 provides a composition of a welding wire having sufficiently high mechanical properties at a minimum splashing of metal in the course of welding. Cited reference 1 specifies components of the composition and contents of the components, with which an excellent welding wire is produced.

As can be seen from the above-mentioned comparison between the present invention and cited reference 1 in terms of object, it seems that the present invention

is very similar to cited reference 1 in that they provide welding wires. However, the present invention, which provides a welding wire with high feeding performance by closely examining new characteristics of the wire, is definitely different from cited reference 1, which provides a composition of the welding wire comprising various components each comprising a specified percentage of the composition.

(2) Construction

The welding wire of the present invention is an arc welding solid wire whose surface comprises a copper plated film, characterized in that the elastic limit ratio, which is defined by the following equation, of the finally produced wire is controlled in the range between 50 and 88 %.

$$\text{Elastic limit ratio} = \text{Elastic limit} / \text{Tensile strength}$$

The aforesaid elastic limit ratio is controlled by installing three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers, each of which has a ratio D/d equal to 40 to 60 (where D is a roller diameter, and d is a wire diameter) following coil control vertical and transverse rollers after final drawing.

On the other hand, the welding wire of cited reference 1 is a welding wire whose composition comprises 0.03 to 0.25 mass % of carbon, 0.8 to 2.2 mass % of manganese, 0.7 to 2.2 mass % of silicon, 0.005 to 0.2 mass % of aluminum, 0.01 to 0.25 mass % of chromium, 0.01 to 0.25 mass % of copper, 0.01 to 0.25 mass % of nickel, 0.001 to 0.02 mass % of calcium, 0.01 to 0.1 mass % of rare-earth metals, and the balance of iron.

The following is described at the upper part of the fifth column, which is part of "DETAILED DESCRIPTION OF THE INVENTION" section, of cited reference 1.

"Making wire rods of 5.5 - 6.5 mm diameter from the proposed composition is technologically simple. The mechanical properties of the wire rod are as follows: ultimate strength not over 740 MPa, reduction of area not under 48 %. The welding wire produced from wire rods can be made by cold drawing of the wire rod to a diameter of

0. 8 mm and over with or without subsequent copper plating. The ultimate strength of the produced welding wire is 830 to 1320 MPa."

The Examiner in charge has the opinion that cited reference 1 discloses the ultimate tensile strength of 830 to 1320 MPa although it does not teach the exact yield strengths.

However, the aforesaid ultimate tensile strength is merely the ultimate tensile strength of the wire having a diameter of 0.8 mm.

The present invention limits the ratio of the elastic limit to the tensile strength to specific ranges to improve the feeding performance of the welding wire. The elastic limit is a value corresponding to the permanent elongation ratio of 0.05 % on the stress-elongation ratio diagram of Fig. 5 of the present application. The present invention does not specify the diameter of the wire and the ranges of the tensile strength as in cited reference 1.

Furthermore, the present invention provides the elastic limit ratio control rollers to control the elastic limit ratio. According to the present invention, the welding wire passes through three to eight elastic limit ratio control vertical rollers and three to eight elastic limit ratio control transverse rollers, each of which has a ratio D/d equal to 40 to 60. The elastic limit ratio control rollers are composed of five U-shaped hang-on rollers between guide rollers, as shown in Fig. 7 of the present application. The elastic limit ratio of 50 to 88 % cannot be obtained only by drawing. It should be noted that the elastic limit ratio can be controlled by using the elastic limit ratio control rollers of the present invention.

Cited reference 1 does not teach the elastic limit at all. Cited reference 1 merely discloses the mechanical properties, such as the tensile strength and the yield strength, of the welding wire having the composition clearly described in the specification of cited reference 1. The tensile strength and the yield strength are the mechanical properties of common wires, which are not novel. Furthermore, the cited reference 1 discloses no apparatus for controlling the mechanical properties of the welding wire. Consequently, cited reference 1 merely discloses the composition of the welding wire.

As can be seen from the above-mentioned comparison between the present invention and cited reference 1 in terms of construction, the present invention, which

provides an apparatus for controlling the mechanical properties of the welding wire to obtain the welding wire with improved mechanical properties, is definitely different from cited reference 1, which merely claims the composition of a welding wire. Moreover, there is no recognition of the problem which is solved by the present, let alone its solution which is the subject of the presently claimed invention. The necessary motivation to modify the references to arrived at the presently claimed invention is not present in the prior art. Obvious to try is not the standard of obviousness under 35 USC 103(a).

(3) Effect

According to the present invention, feeding performance and arc stability of the welding wire is highly improved. Consequently, good welding beads which have neither slag inclusion nor meandering beads, and also less spatter, can be easily achieved.

As indicated in Table 1 of the specification of the present application, if the elastic limit ratio of the wire itself is controlled in the range between 50 and 88 %, it is clear that neither slag inclusion nor meandering bead occurs, resulting in decrease of current on welding and the number of spatters each having a diameter of over 1 mm, so that a good welding bead can be achieved. Consequently, the welding wire having the elastic limit ratio in the range between 50 and 88 % has a remarkably distinct effect as compared to other wires each having the elastic limit ratio outside of the range between 50 and 88 %. The reduction rate of a coil diameter y is decreased up to nine times, and the arc height x is decreased up to five times, especially when the ratio D/d is 40 to 60 and the number of the U-shaped hang-on rollers is 3 to 8. In case where the wire has the elastic limit ratio of the range between 50 and 88 %, the contact of the wire with the inner wall of the cable is considerably decreased, whereby the feeding performance of the wire is improved.

On the other hand, cited reference 1 merely teaches the ultimate strength of the welding wire having the composition specified in the specification of cited reference 1. Cited reference 1 dose not teach the effect obtained by providing the ultimate strength. Moreover, cited reference 1 does not specify ranges of the ultimate strength. Cited

reference 1 merely discloses that the ultimate strength of the wire having a diameter of 0.8 mm is 830 to 1320 MPa.

As can be seen from the above-mentioned comparison between the present invention and cited reference 1, the present invention is also quite different from cited reference 1 in terms of effect. According to the present invention, the elastic limit, which is a novel mechanical property of the present invention, is presented, and the rollers for controlling the elastic limit ratio are provided. Consequently, the welding wire of the present invention has excellent feeding performance and arc stability as well as other superior characteristics of the wire.

(4) Conclusion

As mentioned above, the present invention is quite different from cited reference 1 in terms of object and construction. Furthermore, the present invention has the effect different from cited reference 1 since the construction of the present invention is different from that of cited reference 1. The present invention specifies the elastic limit ratio, and provides an apparatus for controlling the elastic limit ratio within the specific ranges. Consequently, the present invention provides a welding wire with improved feeding performance, by which the wire can be produced with high efficiency.

2. Detailed comparison between the present invention and cited reference 2

Cited reference 2 generally discloses various properties of a welded metal sample welded with a shielded metal arc welding rod given in the specification of American Welding Society (AWS) . The examiner in charge has the opinion that cited reference 2 discloses the mechanical properties which range from 450 to 830 MPa for tensile strengths and 390 to 740 MPa for yield strengths, and the resulting ratios range from 45 to 88 %.

The properties considered in a tensile test of the metal will be hereinafter described in detail.

Appl. No. 09/926,003

Response dated: August 22, 2003

Reply to OA of: March 25, 2003

The properties related to the mechanical deformation of the metal material are called the mechanical properties of the material. The test for measuring the mechanical properties is generally classified into a static test and a dynamic test on the basis of status and condition of a load. The most widely utilized static test is a tensile test, which is provided for measuring the strengths of metals or alloys. The tensile test is carried out at a normal temperature to measure the properties of the material, such as yield strength, tensile strength, drawing ratio, reduction rate of section, etc.

A basic diagram which can be obtained from the tensile test is a load-elongation diagram showing the relation between the applied load and the resultant elongation. The strength of a load acting on unit cross-sectional area when the load is applied is called stress, and the ratio of the amount of change of the original gauge length on the basis of the applied load to the original gauge length is called strain. The load is divided by the original cross-sectional area, and the elongation is divided by the original gauge length on the load-elongation diagram, to obtain a stress-strain diagram. Fig. 1 shows an exemplary stress-strain diagram of soft steel, which is given below.

Fig. 1

The points on the stress-strain diagram represent the properties as indicated in Table 1, which is given below, respectively.

[-Table 1]

1	Proportional limit	The maximum stress at which the curve in the stress-strain diagram is a straight line, i.e., the strain is linearly proportional to the stress.
2	Elastic limit	The maximum stress at which the material will return to its original state without causing permanent deformation after the load applied approximately at the proportional limit is removed. It is difficult to determine the exact elastic limit. For this reason, the stress at which permanent deformation of the material is substantially caused to some extent is defined as the elastic limit. Generally, the value of 0.01 to 0.03 % is adopted as the ratio of the permanent deformation.
3	Yield point	After it exceeds the elastic limit, the stress increases logarithmically. However, there exists a point at which the deformation of the material is abruptly increased even though the load is not increased after the stress exceeds the elastic limit. The point is called an upper yield point. At this time, a plastic flow is generated due to a slip in the metal material, by which large inner transposition is caused to generate a lower yield point. The permanent deformation is further increased as the material exceeds the lower yield point. Generally, the yield point means the lower yield point.
4	0.2 % offset yield strength	Copper or aluminum does not have a sharply defined yield point. Therefore, the point at which the material has 0.2 % of the ratio of the permanent deformation is considered as the yield point, which is called 0.2 % offset yield strength or proof stress.
5	Ultimate Strength	After it exceeds the yield point, the material is hardened. Consequently, the deformation is increased only when the load is increased. After a prescribed load is applied, the ratio of maximum load applied to the material sample to original cross-sectional area is measured, which is the ultimate strength.

The Examiner in charge has the opinion that the ratio of the yield strength to the tensile strength disclosed in cited reference 2 falls into the scope of the present

invention, which means that the examiner in charge merely considers the yield strength of cited reference 2 as the elastic limit of the present invention. However, the elastic limit is quite different from the yield strength.

Cited reference 2 teaches 0.2 % offset yield strength. The applicant submits documentary evidence I which clearly shows that the yield strength disclosed in cited reference 2 is the 0.2 % offset yield strength. Documentary evidence I shows the specification of a corresponding arc welding rod presented in American Society of Mechanical Engineers (ASME) , which is equivalent to the aforesaid American Welding Society (AWS).

Furthermore, the applicant submits documentary evidence II which clearly shows that the yield strength or proof stress and the elastic limit are quite different concepts. As can be seen from Fig. 10 at page 189 of documentary evidence II, the elastic limit varies widely as the yield point or the proof strength is changed. The elastic limit is decreased even though the proof stress is increased. The proof stress is controllable, while the elastic limit is not controllable.

As mentioned above and can be seen from the documentary evidences submitted herewith, the yield strength of cited reference 2 is quite different from the elastic limit of the present invention. The elastic limit theoretically has the ratio of the permanent deformation at 0.01 to 0.03 % offset, especially at 0.05 % offset according to the present invention. Nevertheless, the Examiner in charge considers the elastic limit as the yield strength, and thus simply divides the yield strength by the tensile strength to compare the ratio of the yield strength to the tensile strength with the elastic limit ratio of the present invention, which is obviously a mistake of the examiner in charge. The ratio of the yield strength to the tensile strength does not correlate to the improvement of feeding performance of the wire.

The yield strength and the tensile strength are obtained at the same time when the tensile test of the relevant material is carried out. Consequently, it is obviously inappropriate that the ratio of the minimum yield strength, which is one of the yield strengths measured at several points of the welding rod of cited reference 2, to the maximum tensile strength, which is also one of the tensile strengths measured at several points of the welding rod of cited reference 2, is set to the lower limit (45 %), and

the ratio of the maximum yield strength to the minimum tensile strength is set to the upper limit (88 %).

The present invention specifies the ratio of the elastic limit to the tensile strength, which is quite different from the ratio of the yield strength to the tensile strength. The ratio of the elastic limit to the tensile strength cannot be obtained only by drawing the wire. The ratio of the elastic limit to the tensile strength can be obtained within the desired ranges only by providing elastic control rollers.

The ratio of the elastic limit to the tensile strength, i.e., the elastic limit ratio is not taught by cited reference 2. Therefore, it is obviously impossible even for those skilled in the technical art to which the invention pertains to suggest a welding wire with improved feeding performance by deriving the elastic limit ratio from cited reference 2 and limiting the elastic limit ratio to specific ranges.

3. Conclusion

The present invention specifies the elastic limit ratio of the wire to provide the wire with improved feeding performance. Also, the present invention provides elastic control rollers to limit the elastic limit ratio to specific ranges. Consequently, the present invention is quite different from cited references 1 and 2 in terms of object and construction. Furthermore, the present invention has the effect different from cited references 1 and 2 since the construction of the present invention is different from those of cited references 1 and 2. In conclusion, it is obviously impossible for those skilled in the technical art to which the invention pertains to derive the aforesaid technical idea of the present invention from cited references 1 and 2, absent Applicants' teaching which would result in impermissible hindsight.

Applicants wish to direct the Examiner's attention to the decision of the CAFC In re Demibiczak, 50 USPQ2d 1614, which is quoted extensively in the following paragraphs for its statement of the criteria for establishing a prima facie case of obviousness. Applicants believe that the present rejection does not establish that the claimed invention is prima facie obvious. The following is from the decision, pages 1616-1618.

Our analysis begins in the text of section 103 quoted above, with the phrase "at the time the invention was made." For it is this phrase that guards against entry into the "tempting but forbidden zone of hindsight," see *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d861, 873, 228 USPQ 90, 98 (Fed. Cir. 1985), overruled on other grounds by *Nobelpharma AB v. Implant Innovations, Inc.*, 141F.3d 1059, 46 USPQ2d 1097 (Fed. Cir. 1998),

Page 1617

when analyzing the patentability of claims pursuant to that section. Measuring a claimed invention against the standard established by section 103 requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. See, e.g., *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d1540, 1553, 220 USPQ 303, 313 (Fed. Cir. 1983). Close adherence to this methodology is especially important in the case of less technologically complex inventions, where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *Id.*

Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. See, e.g., *C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d1225, 1232 (Fed. Cir. 1998) (describing "teaching or suggestion or motivation [to combine]" as an "essential evidentiary component of an obviousness holding"); *In re Rouffet*, 149 F.3d 1350, 1359, 47USPQ2d 1453, 1459 (Fed. Cir. 1998) ("the Board must identify specifically . . . the reasons one of ordinary skill in the art would have been motivated to select the references and combine them"); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (examiner can satisfy burden of obviousness in light of combination "only by showing some objective teaching [leading to the combination]"); *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) (evidence of teaching or suggestion "essential" to avoid hindsight); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297, 227 USPQ 657, 667 (Fed. Cir. 1985) (district court's conclusion of obviousness was error when it "did not elucidate any factual teachings, suggestions or incentives from this prior art that showed the propriety of combination"). See also *Graham*, 383 U.S. at 18, 148 USPQ at 467 ("strict observance" of factual predicates to obviousness conclusion required). Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure

Appl. No. 09/926,003
Response dated: August 22, 2003
Reply to OA of: March 25, 2003


as a blueprint for piecing together the prior art to defeat patentability--the essence of hindsight. See, e.g., *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138, 227USPQ 543, 547 (Fed. Cir. 1985) ("The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time."). In this case, the Board fell into the hindsight trap.

We have noted that evidence of a suggestion, teaching, or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved, see *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37USPQ2d 1626, 1630 (Fed. Cir. 1996), *Para-Ordinance Mfg. v. SGS Imports Intern., Inc.*, 73 F.3d 1085, 1088, 37 USPQ2d 1237, 1240 (Fed. Cir. 1995), although "the suggestion more often comes from the teachings of the pertinent references," *Rouffet*, 149 F.3d at 1355, 47 USPQ2d at 1456. The range of sources available, however, does not diminish the requirement for actual evidence. That is, the showing must be clear and particular. See, e.g., *C.R. Bard*, 157 F.3d at 1352, 48 USPQ2d at 1232. Broad conclusory statements regarding the teaching of multiple references, standing alone, are not "evidence." E.g., ...

The Examiner's attention is also directed to MPEP section 2143.03 which states that all claim limitations must be taught or suggested by the prior art. In *re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In *re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Accordingly, it is most respectfully requested that this rejection be withdrawn.

In view of the above comments, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
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